THE CLAIMS

Having thus described the invention what is CLAIMED is:

1. A process for producing fuel gases from at least one non-gaseous hydrocarbonaceous material, using a two-stage reaction apparatus, comprising the following steps, carried out cyclically:

(a) introducing a non-gaseous hydrocarbonaceous material into a pyrolysis chamber, comprising a first stage of the apparatus, and pyrolyzing said hydrocarbonaceous material therein so as to produce a primary fuel gas mixture, a pyrolysis liquid, and a first carbonaceous residue;

(b) introducing said primary fuel gas mixture and pyrolysis liquid into a second chamber, comprising a second stage of the apparatus and containing a catalyst, and heating said liquid therein, in a substantially non-oxidizing atmosphere, to a temperature of 900° to 1100° C and substantially above the temperature at which pyrolysis is effected in step (a), so as to produce additional fuel gases and additional solid carbonaceous residue, without substantially altering the composition of said primary fuel gas mixture;

(c) withdrawing said primary fuel gas mixture and said additional fuel gas from said second chamber; and

(d) introducing air, oxygen, carbon dioxide or steam into each of said chambers to effect reaction with, and at least partial removal of, said carbonaceous residue therein.

2. The process of Claim 1 wherein said carbonaceous material is heated to a temperature of about 500° to 600° C in said pyrolysis step (a), wherein said primary fuel gas mixture consists primarily of carbon monoxide, methane, and hydrogen, and wherein said catalyst in said second chamber is a silica-gel based catalyst.

3. The process of Claim 1 wherein steam, carbon dioxide, or a mixture thereof is introduced into each of said chambers in said step (d) so as to produce a further quantity of fuel gas.

4. The process of Claim 1 wherein said introducing step (d) effects regeneration of said catalyst in said second chamber.

5. The process of Claim 1 wherein said steps are controlled by electronic data processing means programmed to monitor the formation of at least one gas phase product.

6. The process of Claim 5 wherein said at least one gas phase product is selected from the group consisting of hydrogen, methane, carbon monoxide, carbon dioxide, water, and oxygen.

7. The process of claim 5 wherein the formation of a least three gas phase products are monitored for controlling said steps.

8. The process of Claim 7 wherein said data processing means is programmed to determine the concentrations of said at least three gas phase products, and to implement an artificial neural network model based thereupon, said concentrations being utilized as input data to said neural network.

9. The process of Claim 8 wherein said neural network model is constructed to produce a fuel gas product of selected composition, from a specified hydrocarbonaceous material, by controlling the operating parameters for said first and second stages of the said apparatus.

10. A power generation system, comprising;

a gas-fueled power generator; two-stage reaction apparatus for producing a fuel gas product from a hydrocarbonaceous material, operatively connected to supply fuel gas to said power generator; and means for controlling the flow of fuel gas from said reaction apparatus to said generator, said reaction apparatus being constructed for effecting a process comprising the following steps, carried out cyclically:

(a) introducing a non-gaseous hydrocarbonaceous material into a pyrolysis chamber, comprising a first stage of said apparatus, and pyrolyzing the hydrocarbonaceous material therein so as to produce a primary fuel gas mixture, a pyrolysis liquid, and a first carbonaceous residue;

(b) introducing the primary fuel gas mixture and the pyrolysis liquid into a second chamber, comprising a second stage of said apparatus and containing a catalyst, and heating said liquid therein, in a substantially non-oxidizing atmosphere, to a temperature of about 900° to 1100° C and substantially above the temperature at which pyrolysis is effected in step (a), so as to produce additional fuel gases and additional solid carbonaceous residue, without substantially altering the composition of the primary fuel gas mixture;

(c) withdrawing the primary fuel gas mixture and the additional fuel gas from said second chamber; and

(d) introducing air, oxygen, carbon dioxide or steam into each of said chambers to effect reaction with, and at least partial removal of, said carbonaceous residue therein.

11. The system of Claim 10 additionally including electronic data processing means for controlling the steps of the process, said data processing means being programmed to monitor the formation of at least one gas phase product.

12. The system of Claim 11 wherein said at least one gas phase product monitored by said data processing means is selected from the group consisting of hydrogen, methane, carbon monoxide, carbon dioxide, water, and oxygen.

13. The system of Claim 11 wherein the formation of at least three gas phase products are monitored for controlling said steps.

14. The system of Claim 13 wherein said data processing means is programmed to determine the concentrations of the at least three gas phase products, and to implement an artificial neural network model based thereupon, such concentrations being utilized as input data to said neural network.

15. The apparatus of Claim 14 wherein said neural network model is constructed to produce a fuel gas product of selected composition, from a specified hydrocarbonaceous material, by controlling the operating parameters for the first and second stages of said apparatus.

16. The system of Claim 15 wherein said at least three gas phase products monitored by said data processing means are selected from the group consisting of hydrogen, methane, carbon monoxide, carbon dioxide, water, and oxygen.

17. The system of Claim 10 wherein said catalyst in said second chamber is a silica gel-based catalyst.